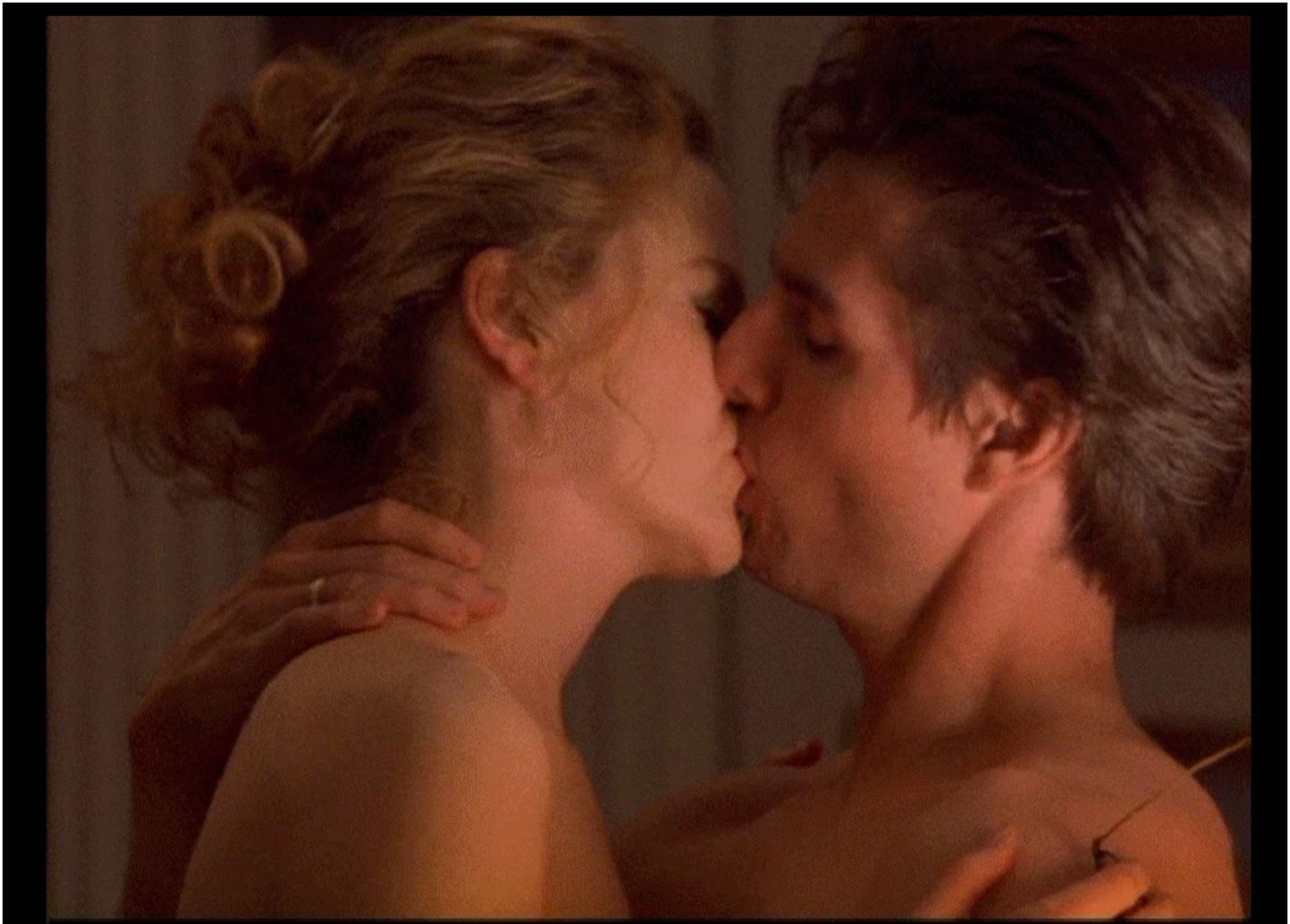
NST IB Psychology

Emotion and motivation – 2

Concepts of motivation; psychological mechanisms for action

Rudolf Cardinal
Department of Experimental Psychology

Thursday 4, Saturday 6, Tuesday 9 March 2004; 11am
Physiology Lecture Theatre 3

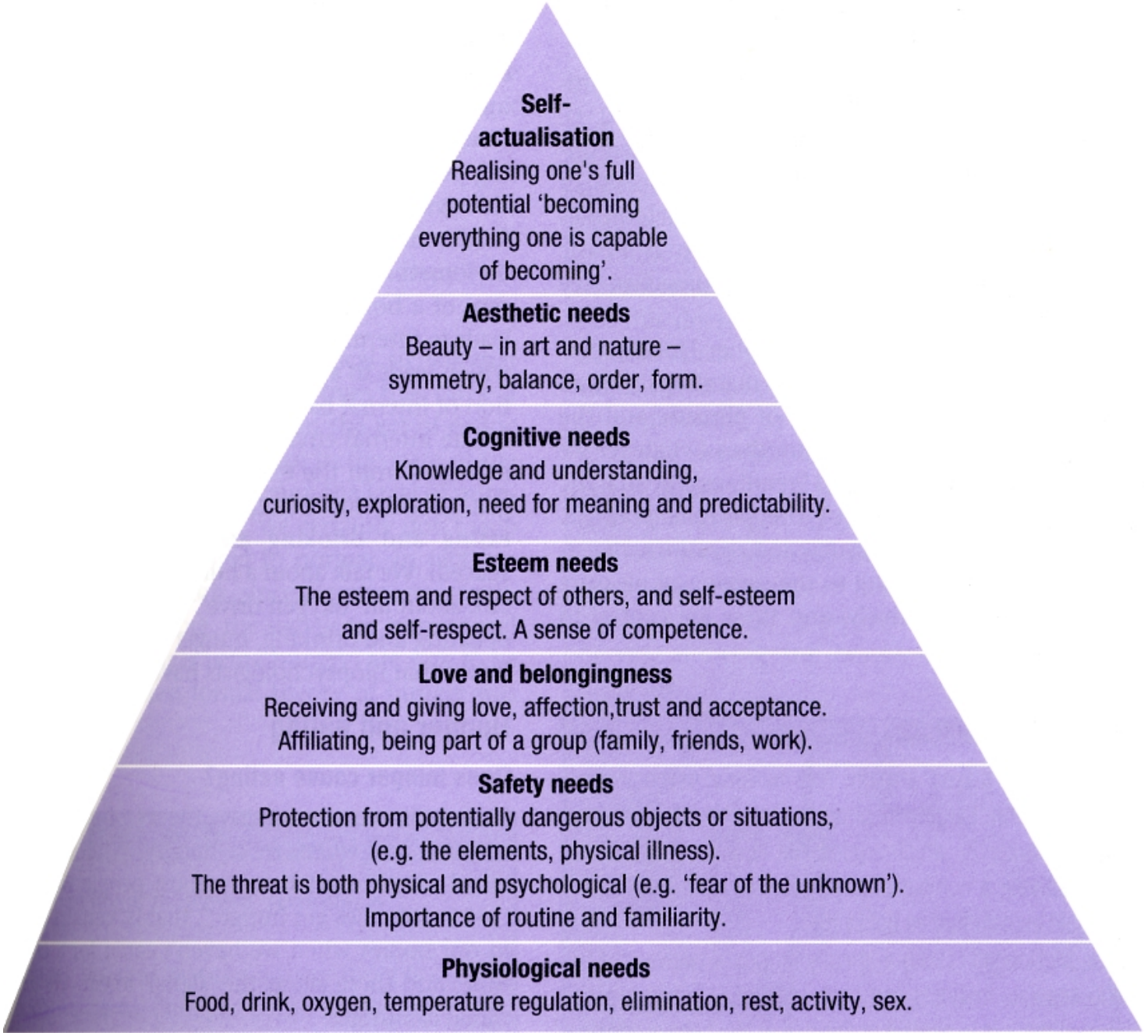


Kubrick (1999): ‘Eyes Wide Shut’

Demme (2001): ‘Blow’

Theories of motivation

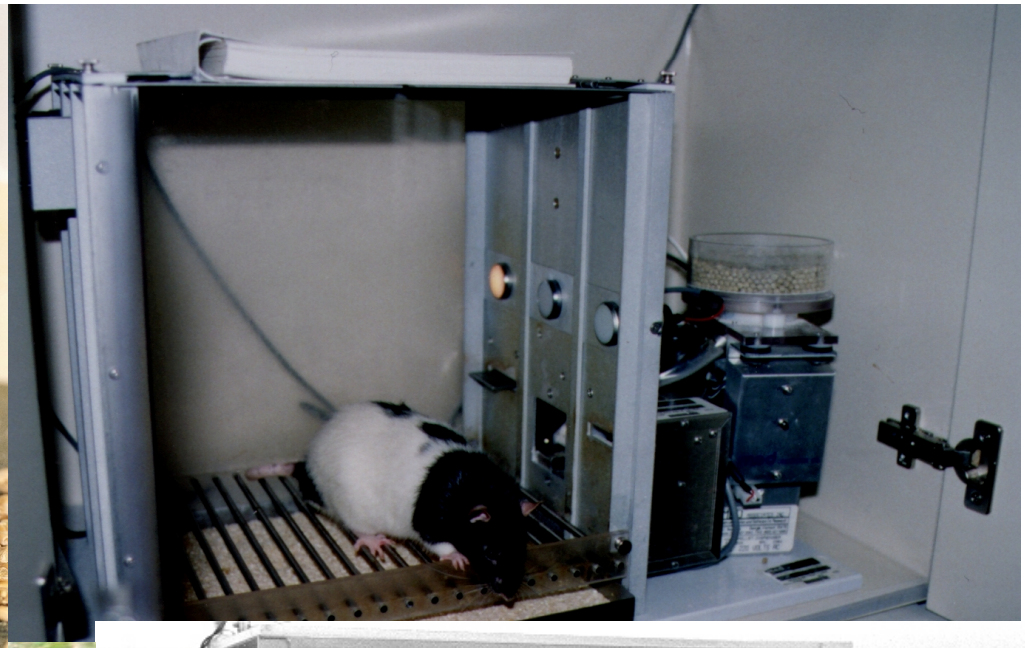
Maslow’s ‘hierarchy of needs’ — not very helpful

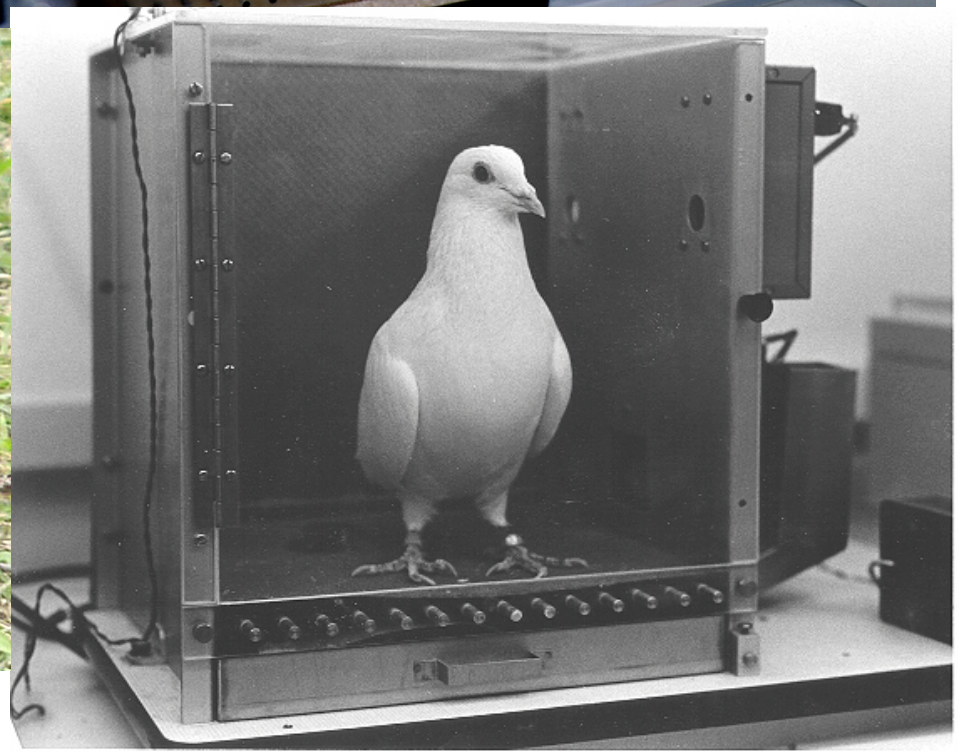


Maslow (1954)

Manigault (1909) ‘The Rocket’

Behaviourism: positive and negative reinforcement





e.g. Skinner (1938)

Behaviourism: avoiding circularity

response R ⟶ outcome O

If the animal performs the response, is there an "O drive"?

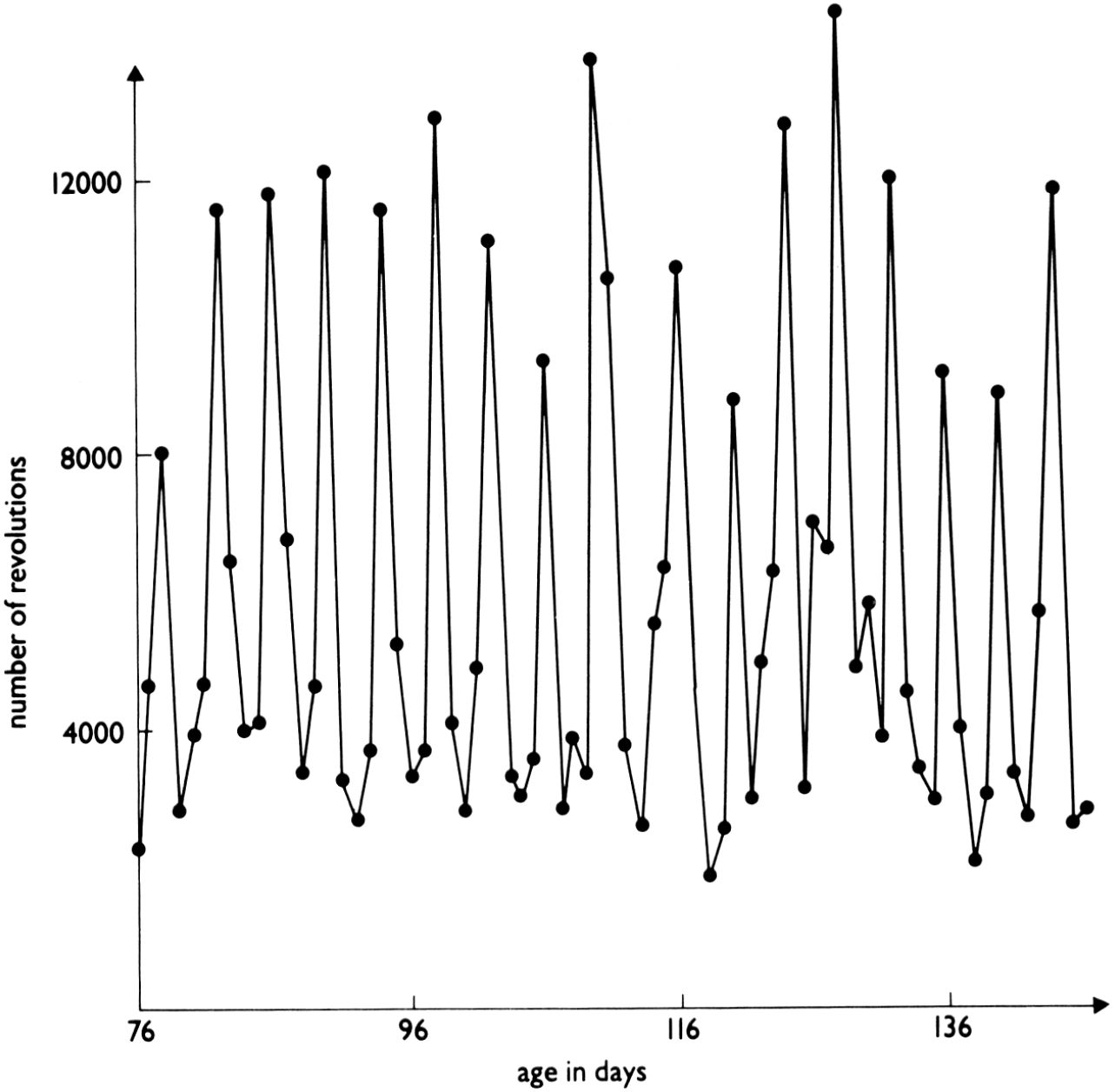
Potentially circular argument: the animal performs response R because it's motivated by O-drive – and we know that O-drive exists because it performs response R…

Even worse: does the animal perform R because it *likes* performing R? Can explain any behaviour this way.

Skinner (1938): define reinforcers by their effects on behaviour. (Can't then say that behaviour alters as a consequence of reinforcement, because that would be circular.)

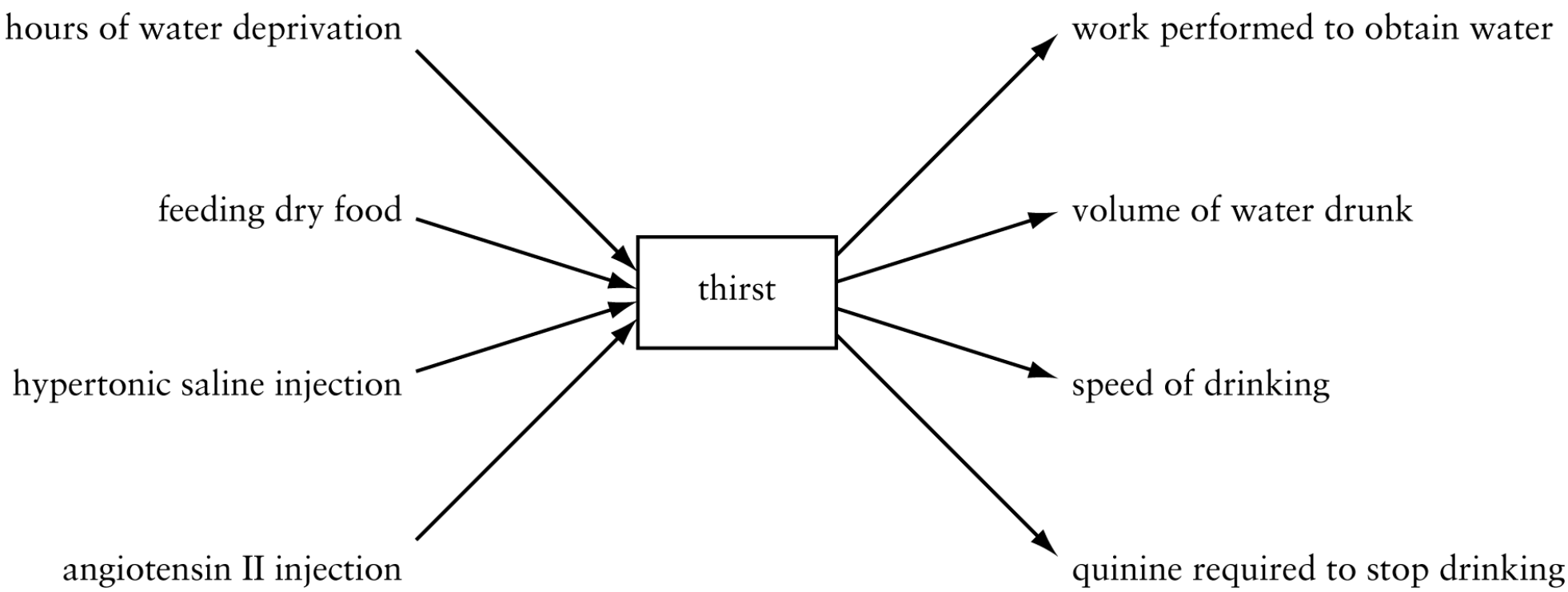
Positive reinforcers are those things that strengthen preceding responses; *negative reinforcers* are those things whose removal strengthens previous responses.

Motivational states as hidden explanatory variables (1)

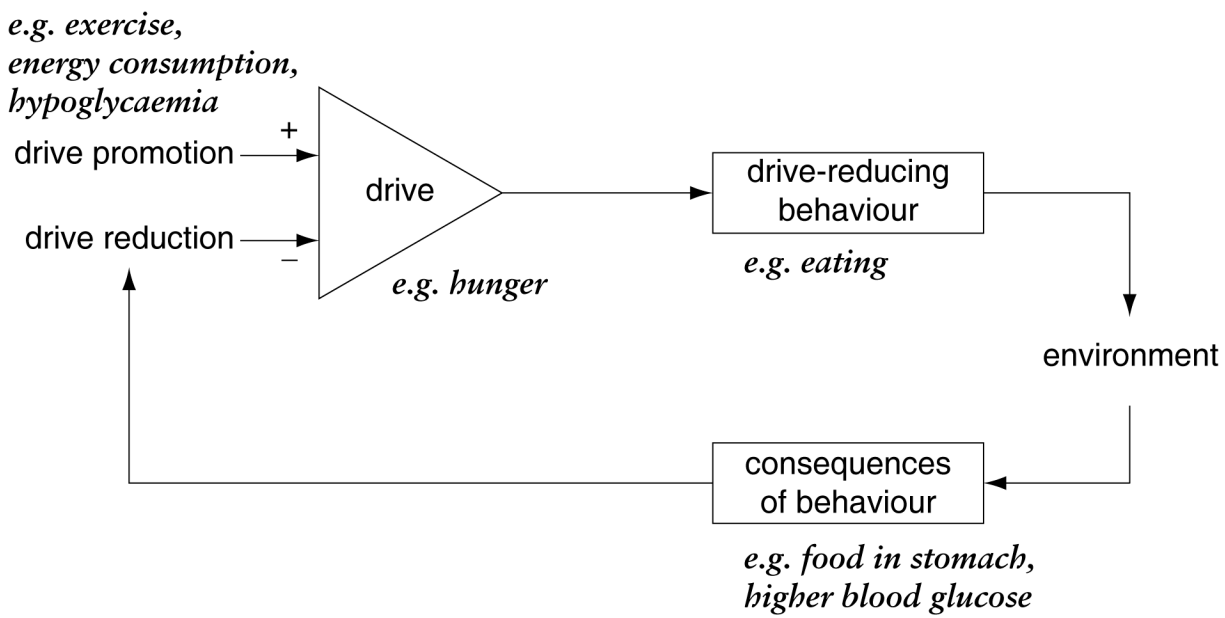


Richter (1927), wheel-running in a female rat

Motivational states as hidden explanatory variables (2)

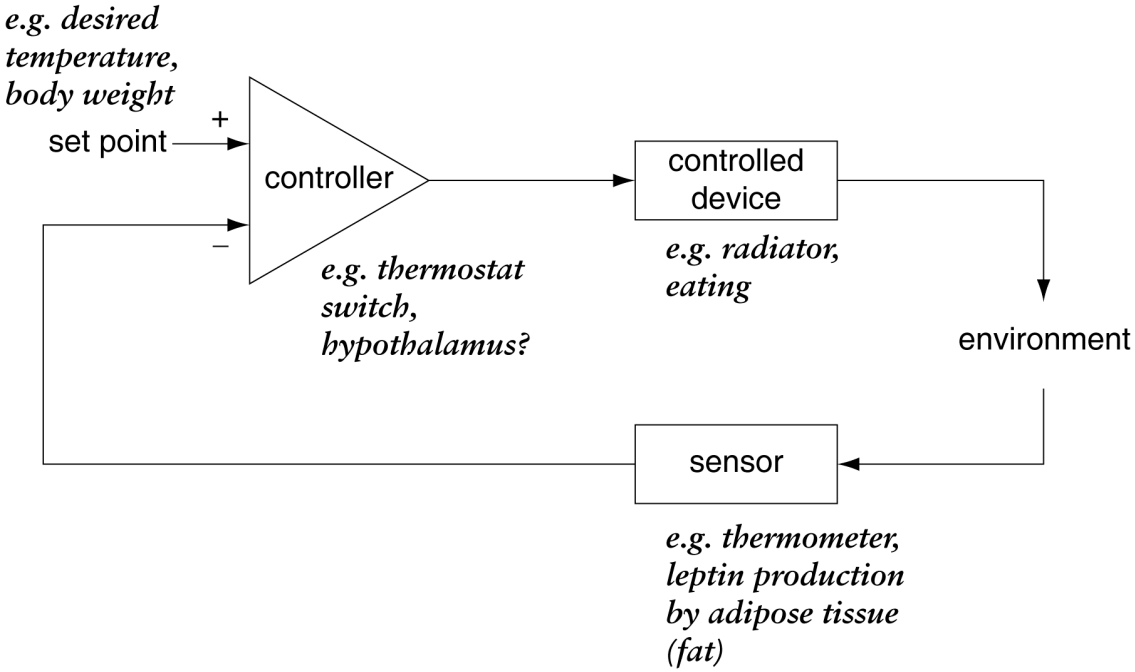


Motivational states, drives, homeostasis

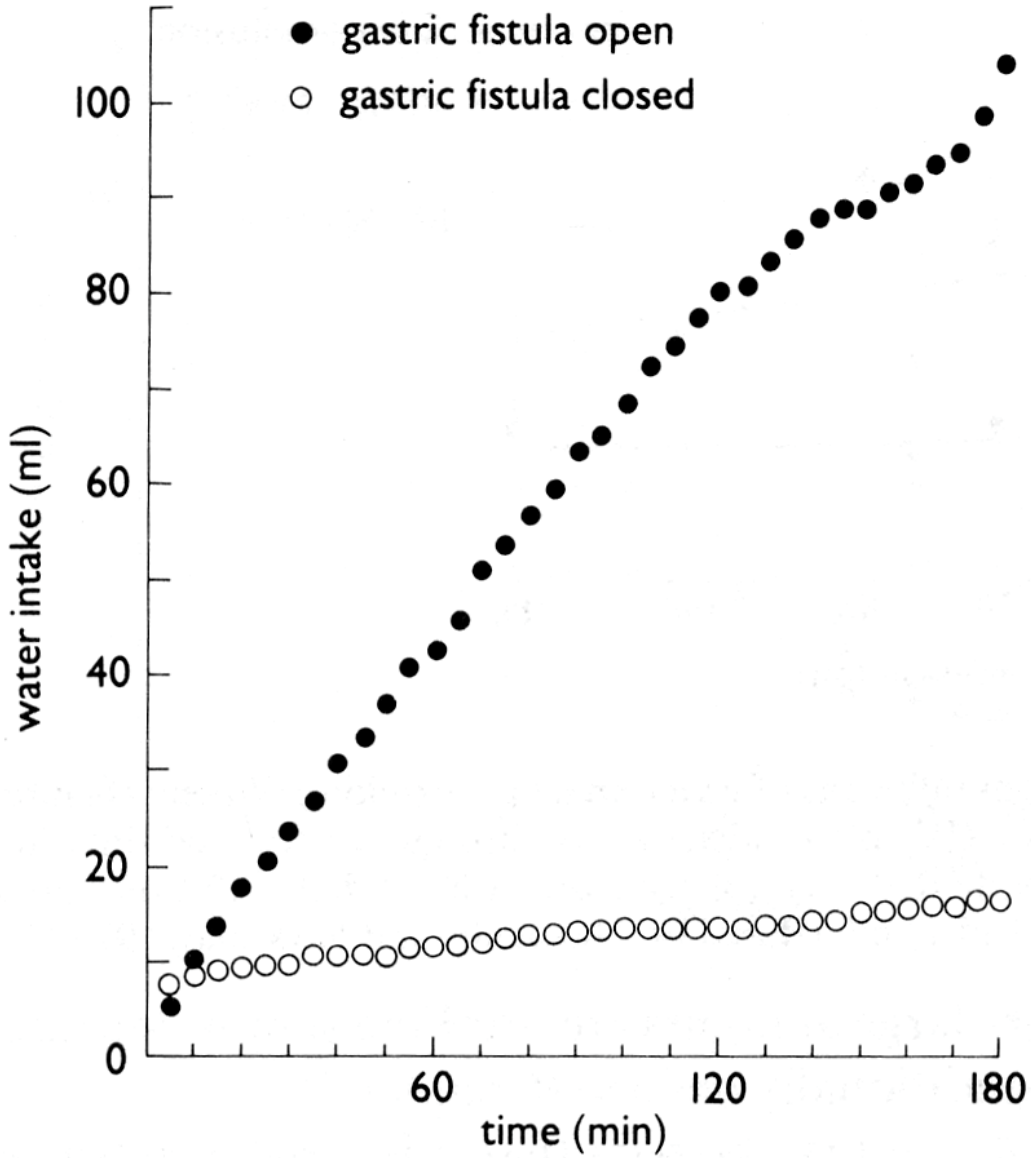


Hull (1943): events that reduce 'drives' are reinforcing.

Homeostasis (a term coined by Cannon). Negative feedback.



Homeostasis in action? Sham drinking



Rolls & Rolls (1982)

Rodents that eat all the pies

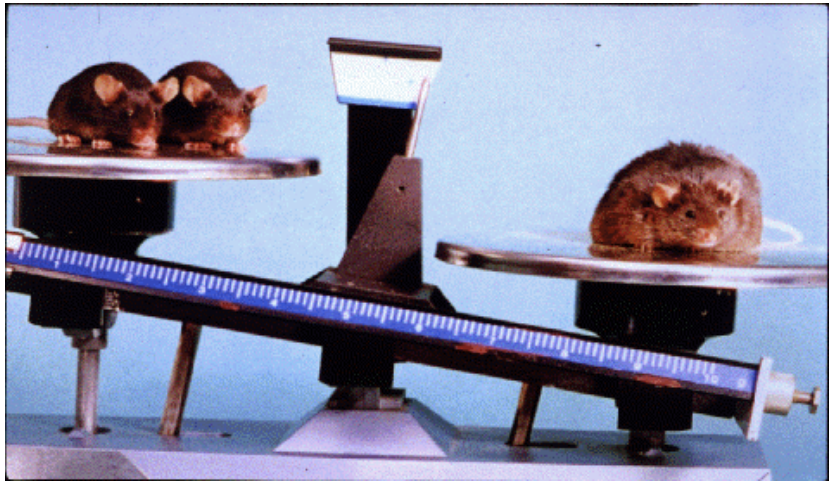
Hetherington & Ranson (1939); Coleman & Hummel (1969)

Left: rat with ventromedial hypothalamic lesion; above: mice with leptin or leptin-receptor deficiency

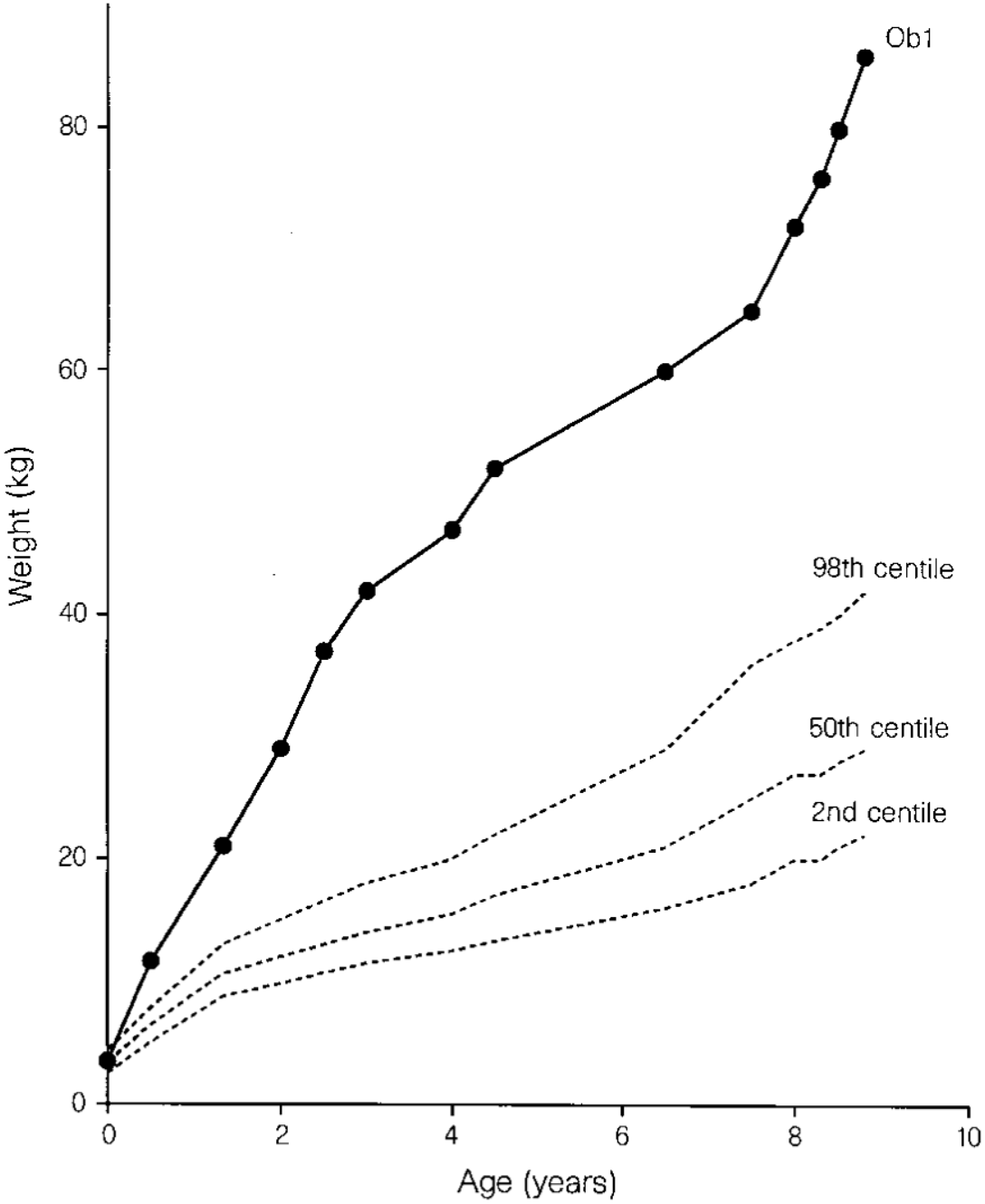
Humans with leptin deficiency get a bit chunky, too (1)

8 year-old girl.
1.37 m tall (75th centile).
86 kg. BMI of 46.
Mobility severely impaired.

BMI = body mass index =
mass in kg / (height in m)^2.
20–25 normal; >25 obese.



(And another picture of the mice.)



Montague et al. (1997)

Humans with leptin deficiency (2)

Before *After treatment with recombinant leptin*

O'Rahilly & Farooqi (2003) www.endotext.org

Not all motivation is obviously homeostatic

What's reinforcing?

What’s reinforcing?

Premack (1963); Hundt & Premack (1953)

Development of theories of reinforcement

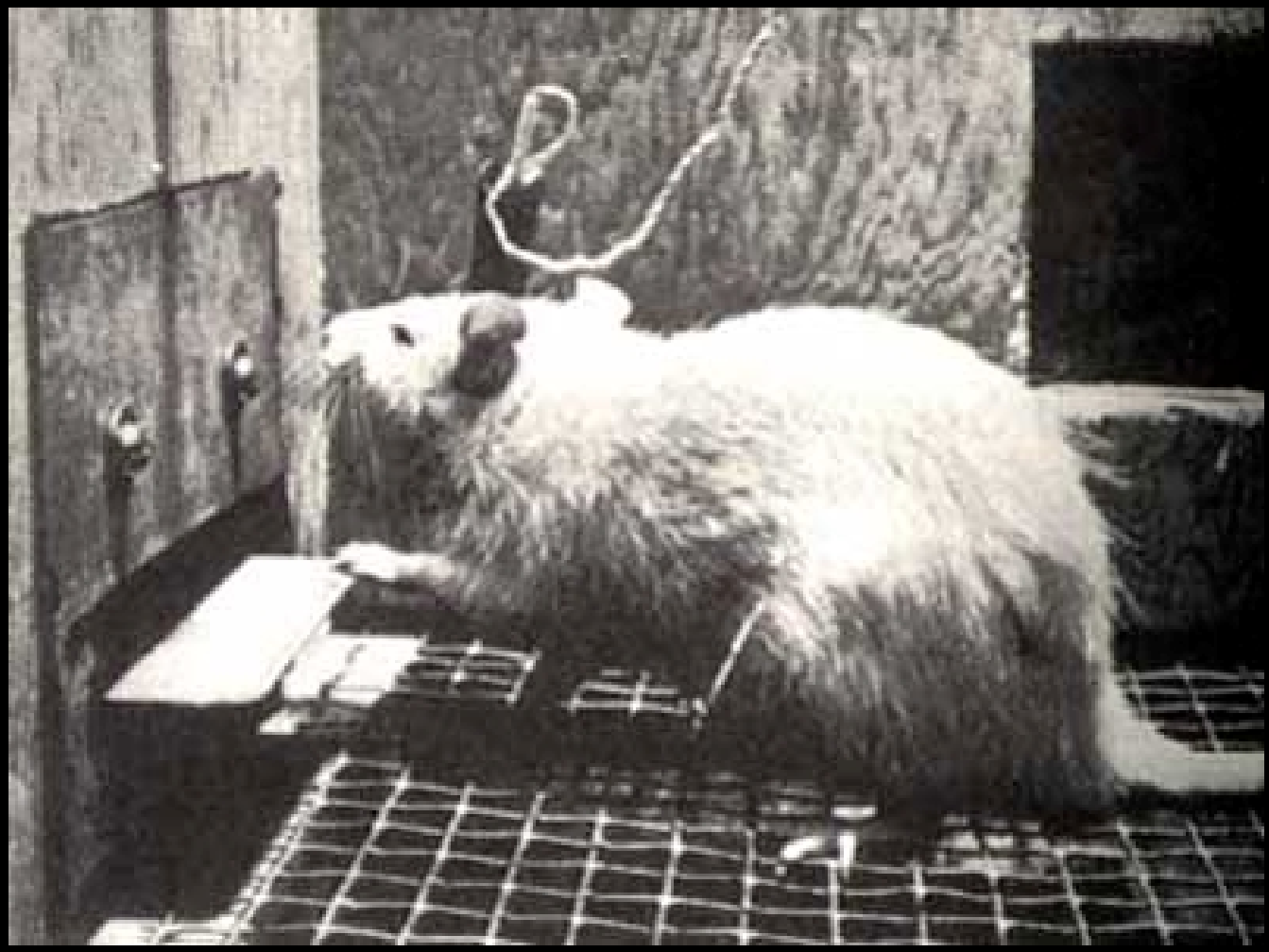
Given a free choice, animals perform some behaviours a lot (with high probability) and others seldom (low probability).

Premack's principle (1963): high-probability behaviours reinforce low-probability behaviours (e.g. if you normally drink more than you run, you'll run in order to be allowed to drink, and vice versa).

Timberlake & Allison (1974): deprived behaviours reinforce less-deprived behaviours (e.g. if you're drinking less than you normally would, you'll do other things in order to be able to drink more).

Hundt & Premack (1953): the same behaviour can be both a positive and a negative reinforcer!

Electrical intracranial self-stimulation (ICSS)



The mind is its own place, and in itself, can make heaven of Hell, and a hell of Heaven.

(Satan, in John Milton's *Paradise Lost*, book 1, ll. 254–5)

Olds & Milner (1954)

Remote-controlled rats (and a cocaine sniffer rat)

Otto *et al*. (2002). *Appl. Animal Behav. Sc.* 77: 217

Talwar *et al*. (2002). *Nature* 417: 37

Psychological basis
of instrumental conditioning

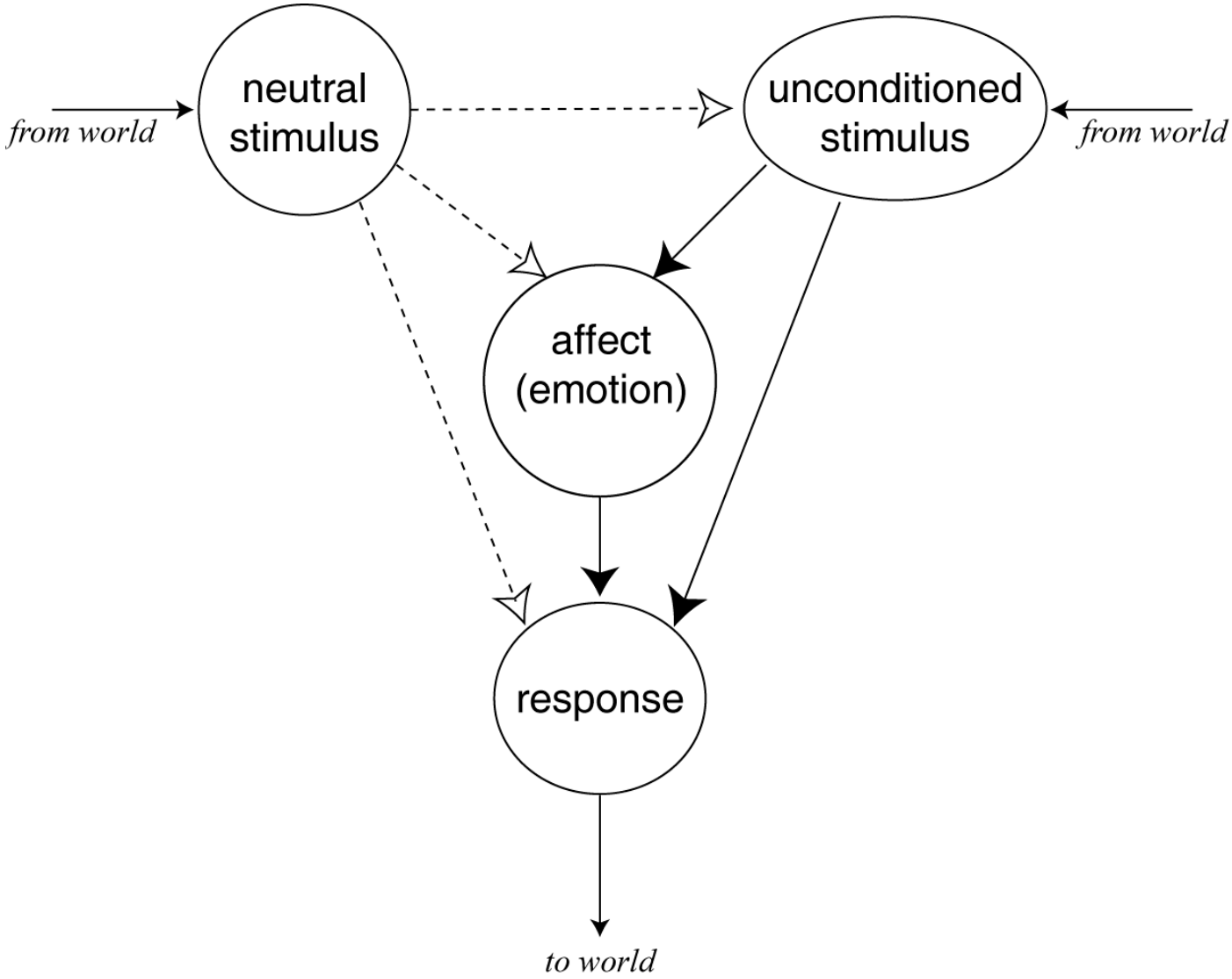
Complex behaviour can be unlearned…

The greylag goose. Hard to catch (hence "wild goose chase").

On the right, a female rolling an egg towards its nest.

Lorenz (1939); Tinbergen (1948)

… and we talked about Pavlovian conditioning last time.



Instrumental versus Pavlovian conditioning

Pavlovian (classical) conditioning

Experimenter arranges a contingency between two stimuli (CS and US), *independent* of the animal's behaviour.

CS typically neutral (no unlearned response).
US typically biologically relevant (unlearned response: UR).

Animal's behaviour is observed. Does it learn to respond to the CS?

Instrumental (operant) conditioning

Experimenter arranges a contingency between an aspect of the animal's behaviour (e.g. pressing a lever) and some stimulus.

Stimulus typically biologically relevant (e.g. food).

Animal's behaviour is observed. Does the probability of that behaviour change?

Instrumental conditioning: some responses can be goal-directed

Bidirectional control:

1. When buzzer sounds, turn head **left** in order to receive carrot (delivered straight ahead).
2. Now, new situation: when buzzer sounds, must turn head **right** in order to receive carrot.

Behaviour changes. Stimulus–outcome (buzzer–carrot) Pavlovian relationship constant; difference is due to behaviour–outcome (instrumental) relationship.

Grindley (1932). Also rats pressing levers (Bolles et al., 1980).

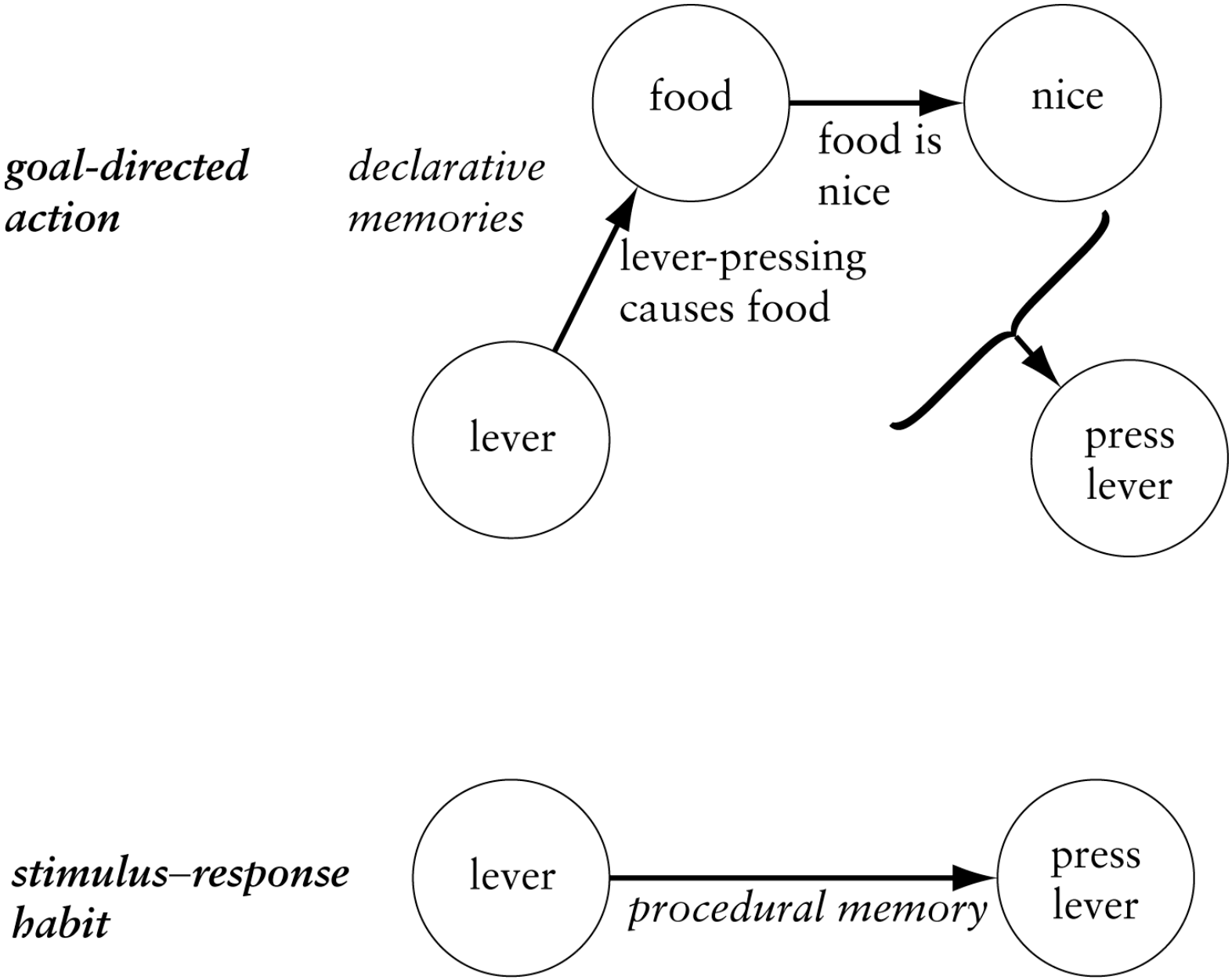
Omission schedule:

- Tone (CS) → food (US), **except** that if the dog salivates (CR), it loses the food.

Dog continues to salivate: this response is under Pavlovian, not instrumental, control.

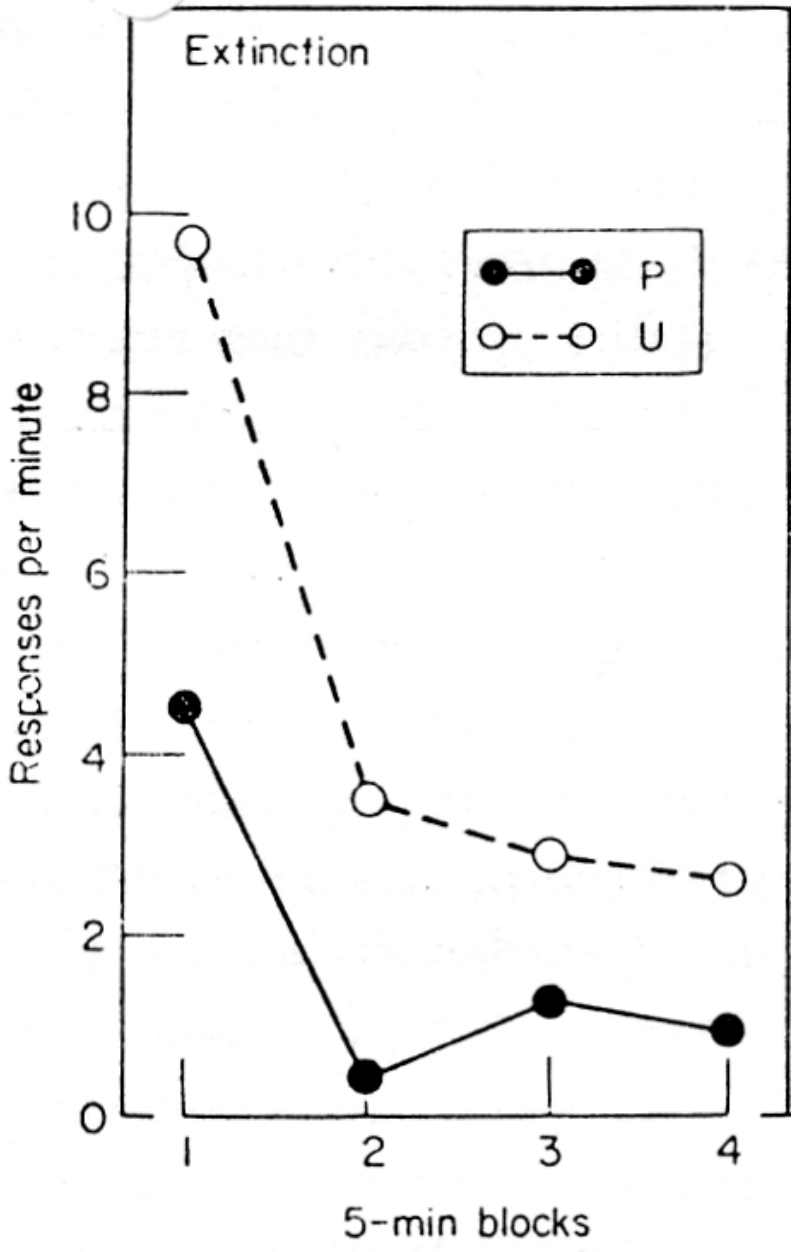
Sheffield (1965)

Animals work for reinforcement for several reasons, including...



after Dickinson (1980)

Goal-directed action



Train rats to press a lever for food A. Give them food B for free.

Poison either food A (group P) or food B (group U).

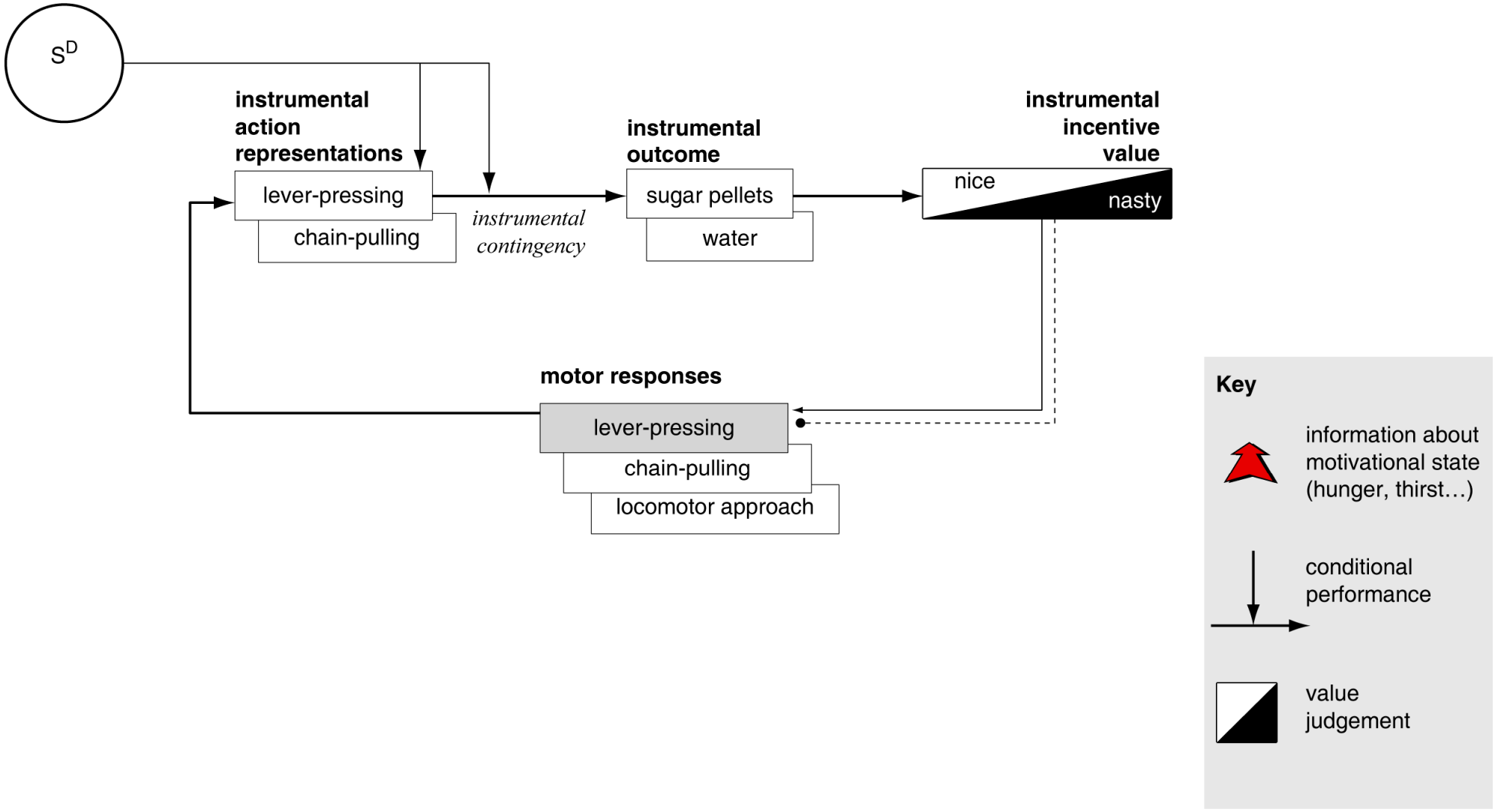
Test responding in extinction (no food).

If their lever-pressing is goal-directed and they represent the **value of the goal,** then group P should press less than group U.

They do.

Adams & Dickinson (1981)

The story so far… (1)



Learning the ‘incentive value’ of foods

Stage	Devalued	*Comparison*	Controls	Change in devalued group
Training	L → food		L → food	
Devaluation	food → LiCl		food	hedonic change
Test 1	L	=	L	
Re-exposure	food		food	incentive learning
Test 2	L	<	L	

L = lever

LiCl = lithium chloride

Balleine & Dickinson (1991)

Learning that food's value depends on your hunger

	Learning group		Controls
Train hungry	L → food		L → food
Incentive learning	sated: food		hungry: food
Test while sated	L	<	L

Have learned that food is less worthwhile when they're sated

	Learning group		Controls
Train sated	L → food		L → food
Incentive learning	hungry: food		sated: food
Test while hungry	L	>	L

Have learned that food is more worthwhile when they're hungry

Based on Balleine (1992)

L = lever

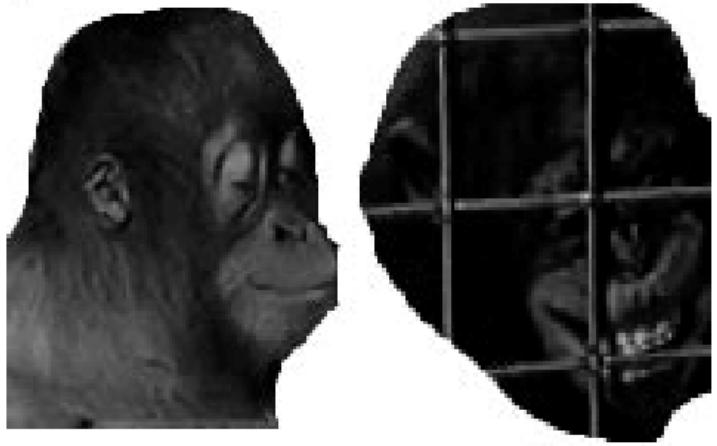
‘Hedonic’ taste reactivity patterns (1)

Hominoids: Apes & Humans

Mid-face Aversion (bitter)

Eye squinch & nose wrinkle

Midface ‘Smile’ (sweet)



Elevation & relaxation

Berridge (2000)

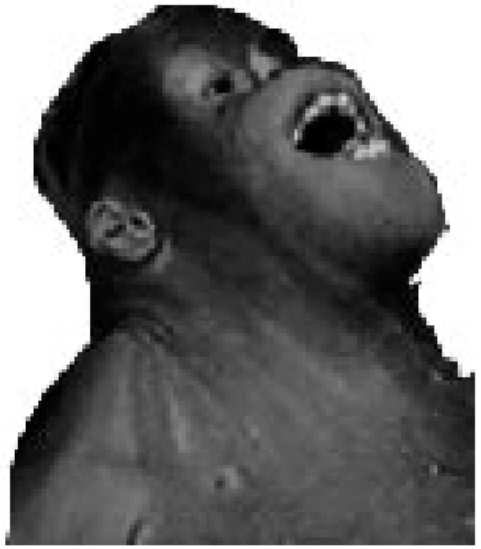
‘Hedonic’ taste reactivity patterns (2)

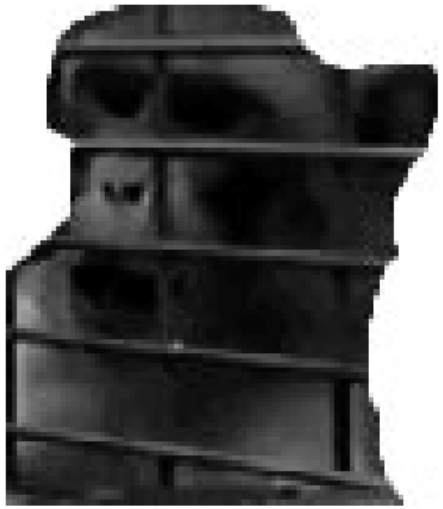
‘Universal hedonic reaction’ — tongue protrusion to sweet substances

Berridge (2000)

‘Hedonic’ taste reactivity patterns (3)

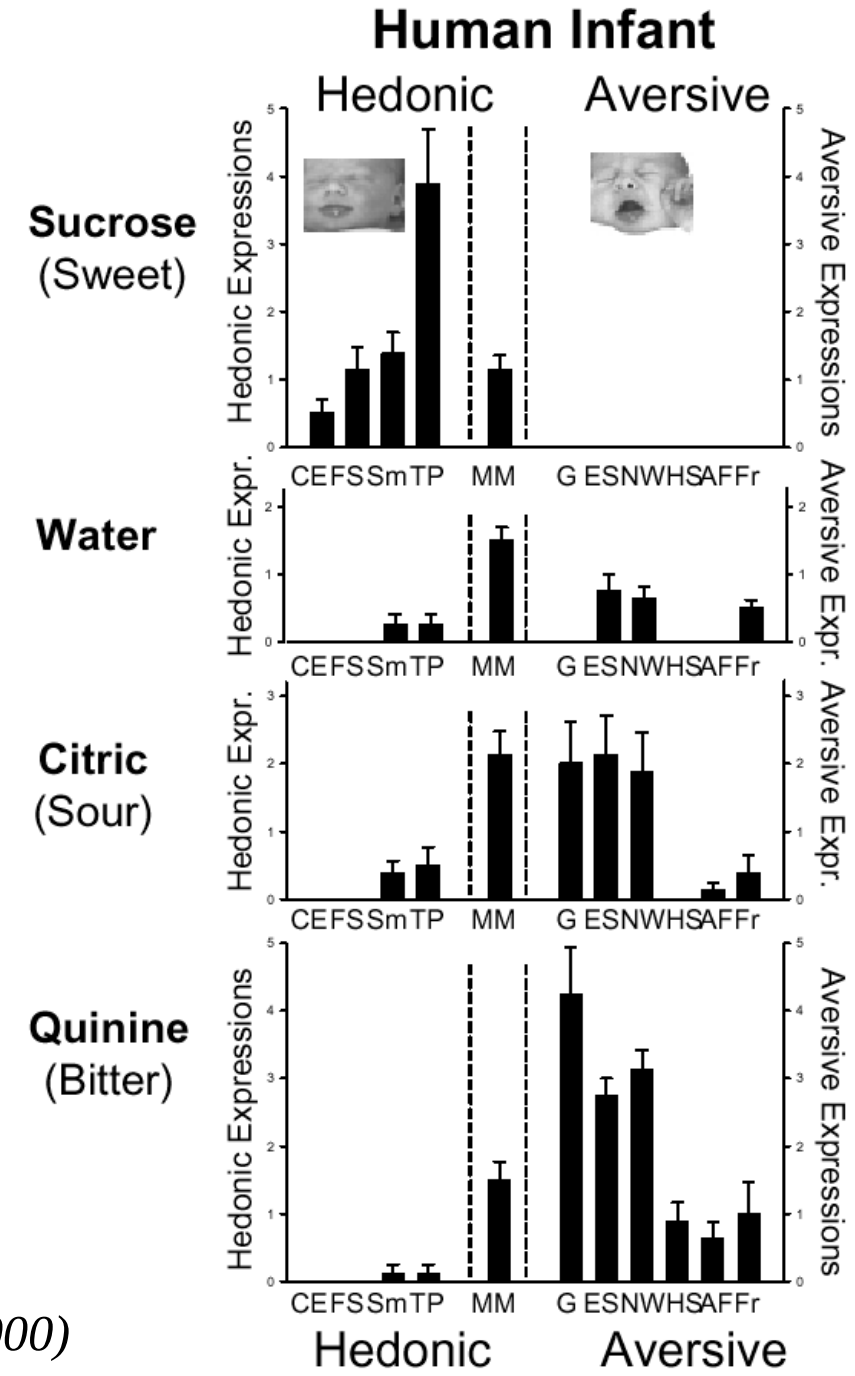
‘Universal aversive reaction’ — gaping to bitter substances

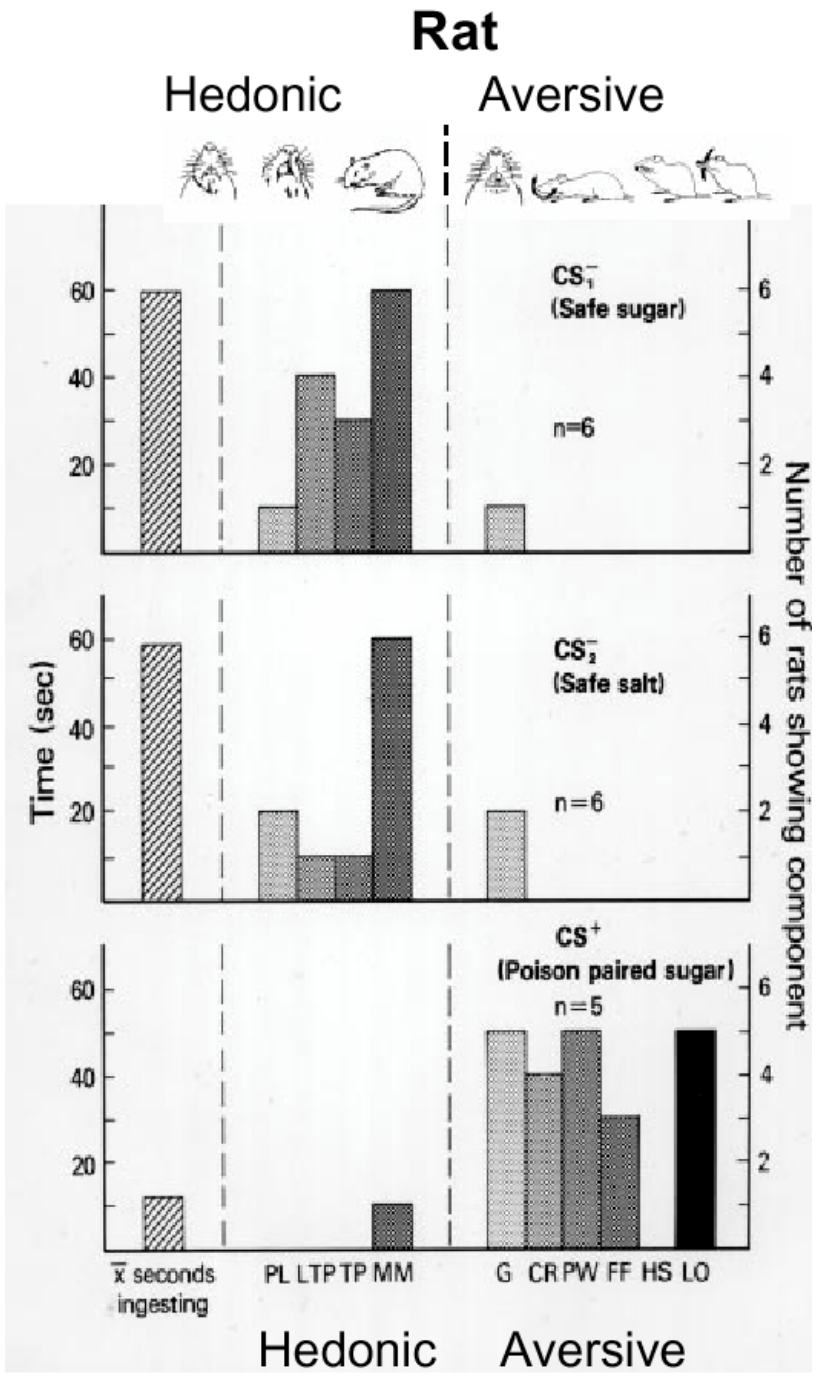




Berridge (2000)

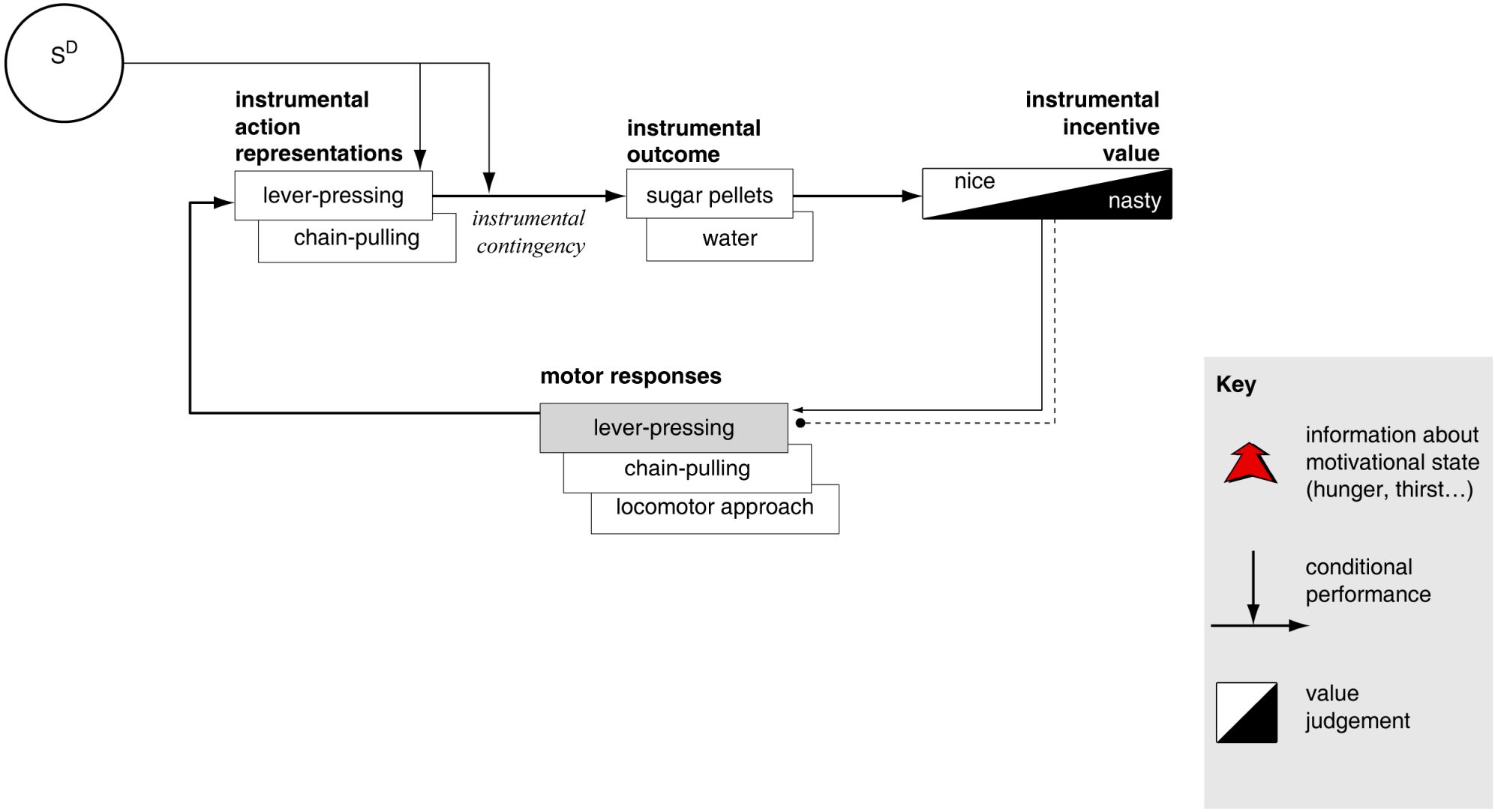
‘Hedonic’ taste reactivity patterns (4): they can alter



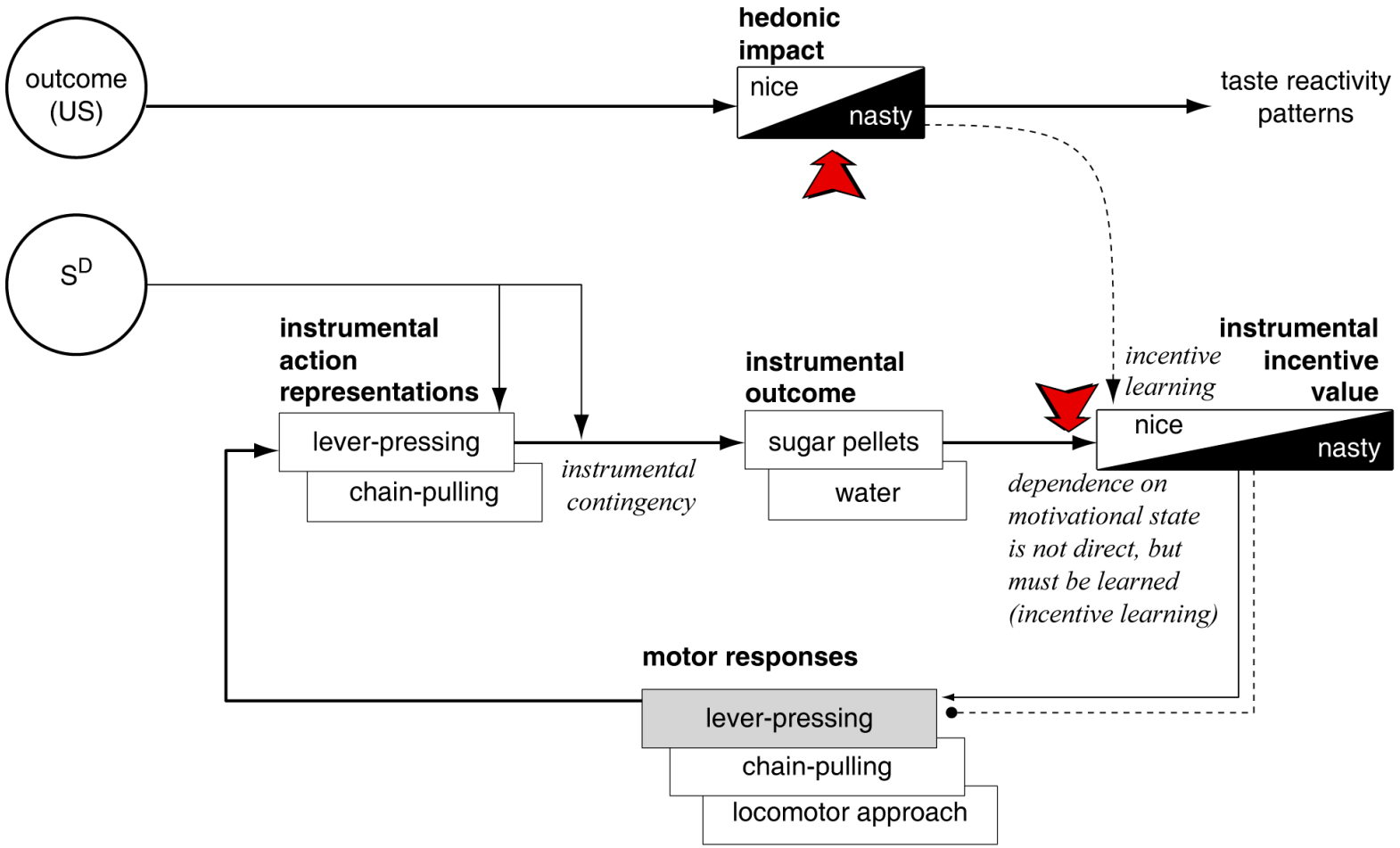


Berridge (2000)

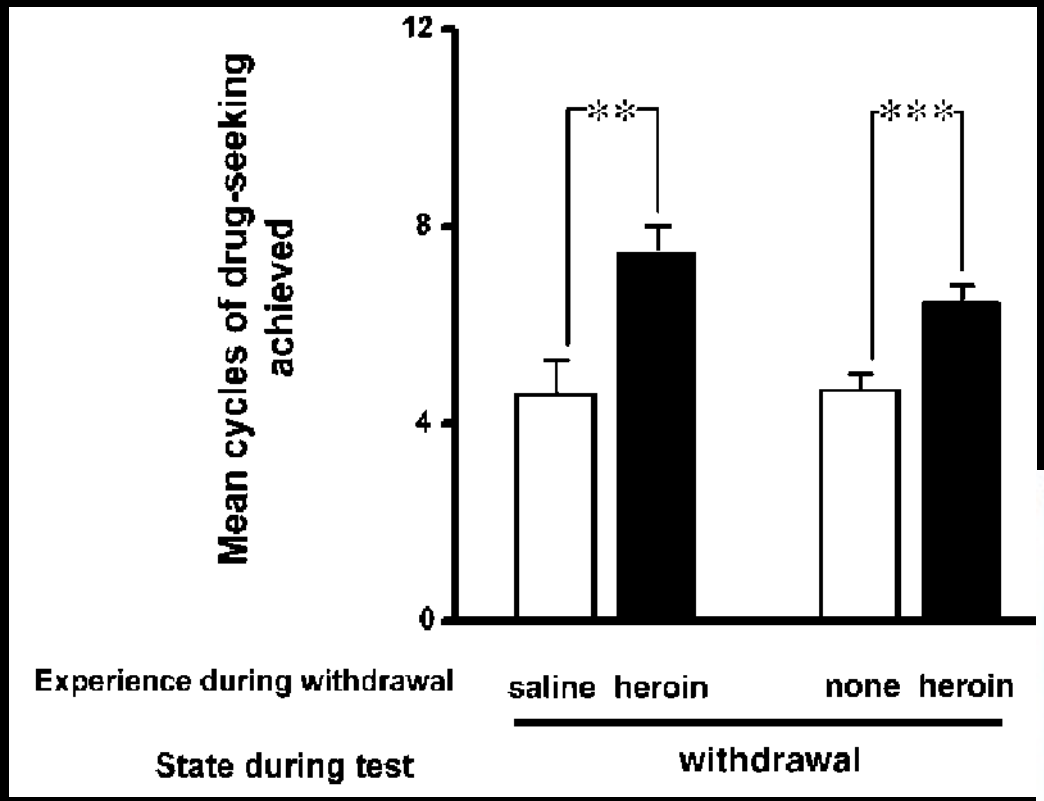
The story so far… (1)



The story so far… (2)

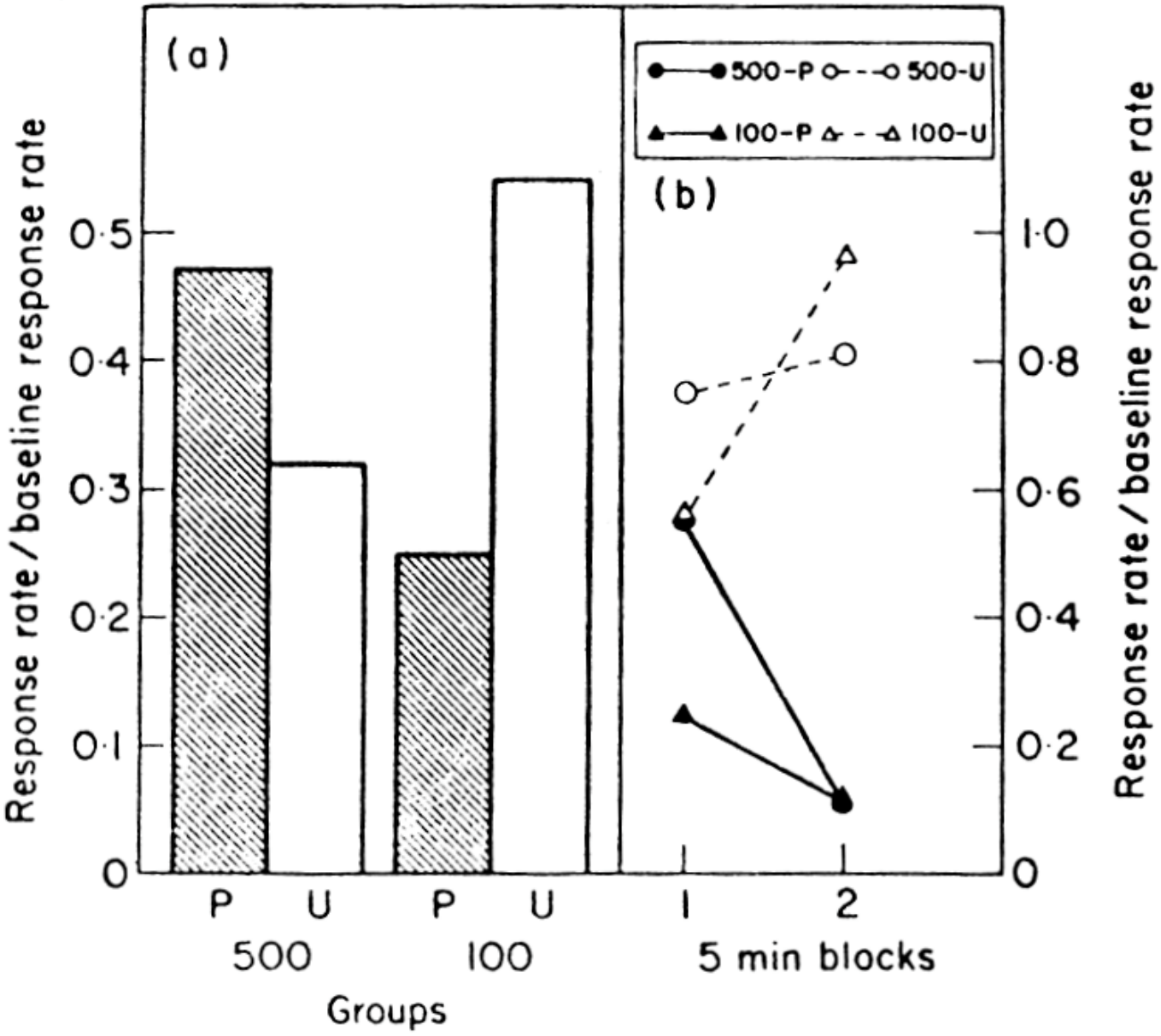


Learning the ‘incentive value’ of heroin



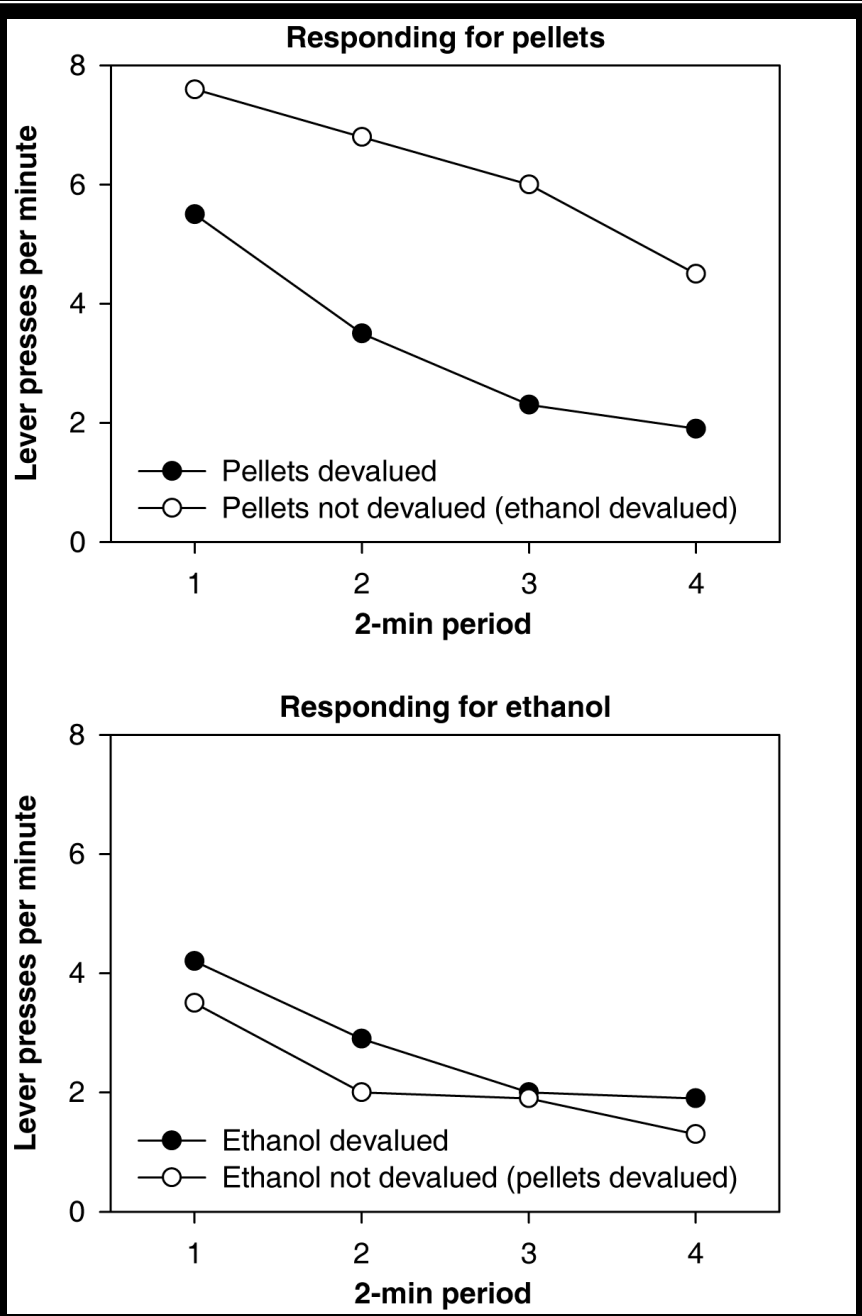
Hutcheson et al. (2001)

Stimulus–response habits develop after extended training



Adams (1982)

Is alcohol-seeking more ‘habitual’ than goal-directed?



Dickinson et al. (2002) experiment 2, figure 6 redrawn

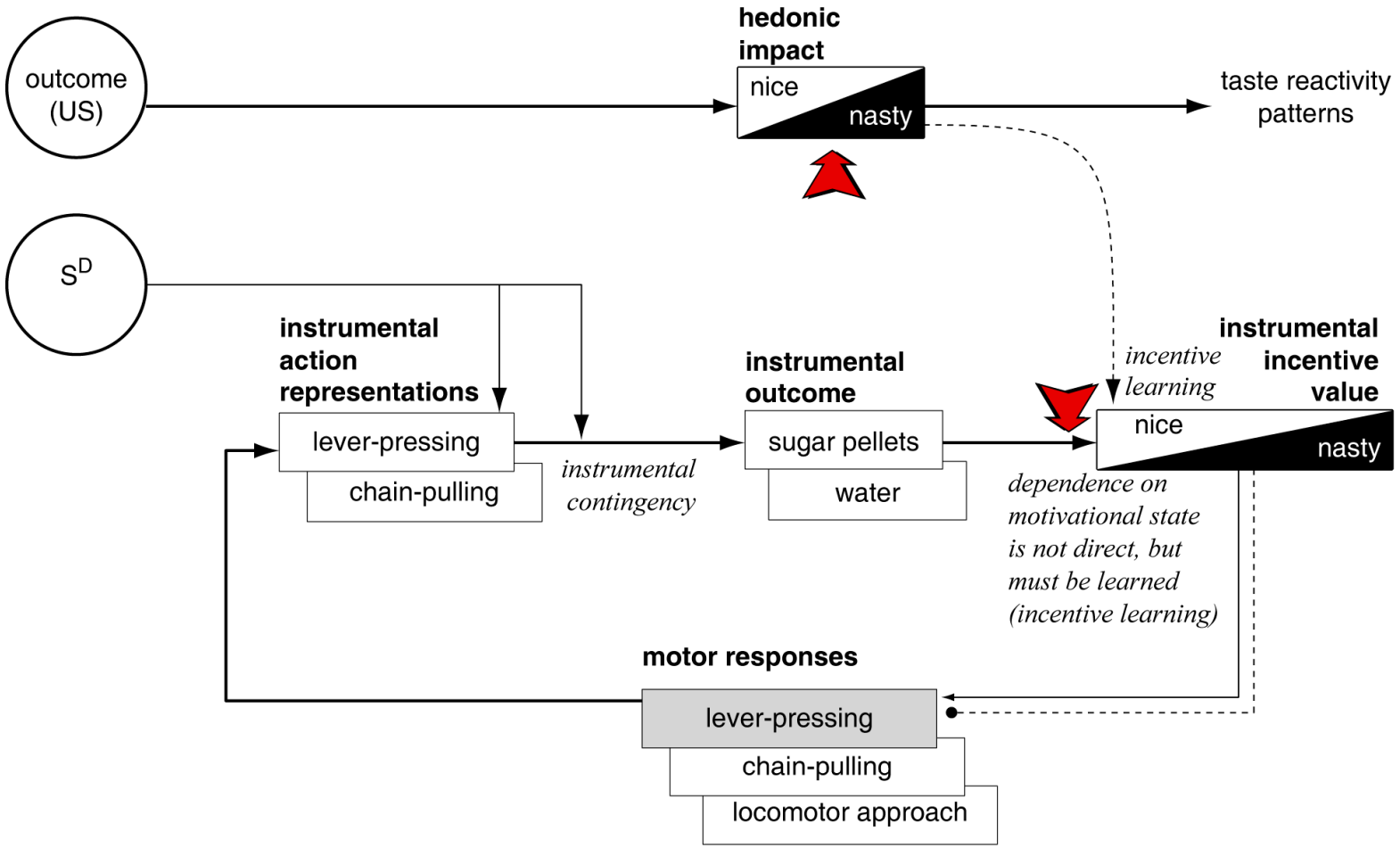
Companies may have learned from rat experiments!

Sucrose 'fading' procedure: from e.g.

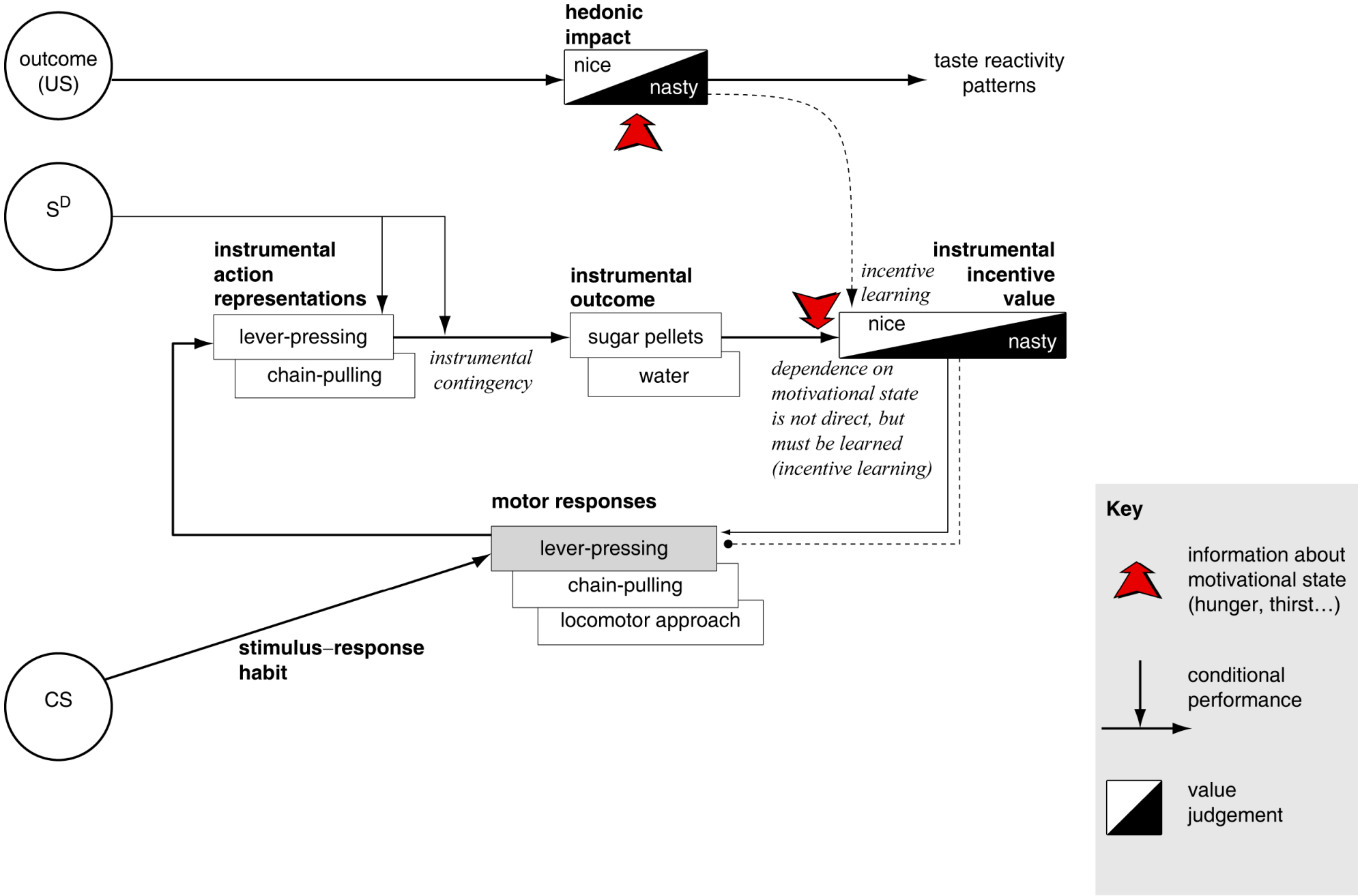
- *20% sucrose*
- *20% sucrose, 5% ethanol*
- *…*
- *5% sucrose, 10% ethanol*
- *…*
- *40% ethanol*

Samson (1986), rats; 1995 saw introduction of alcopops to UK

The story so far… (2)



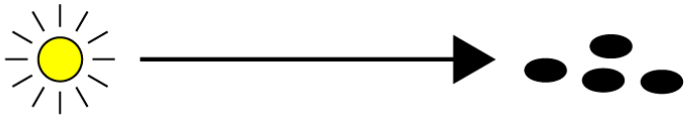
The story so far… (3)



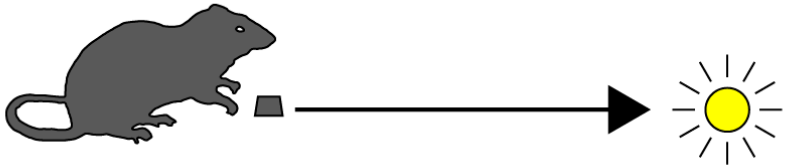
Cues paired with reinforcement can also motivate

Conditioned reinforcement

Training

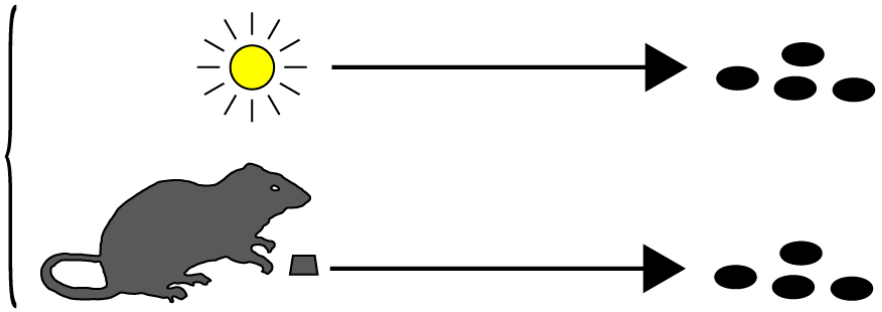


Test

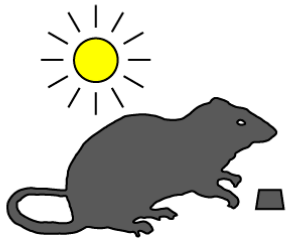


Pavlovian–instrumental transfer (PIT)

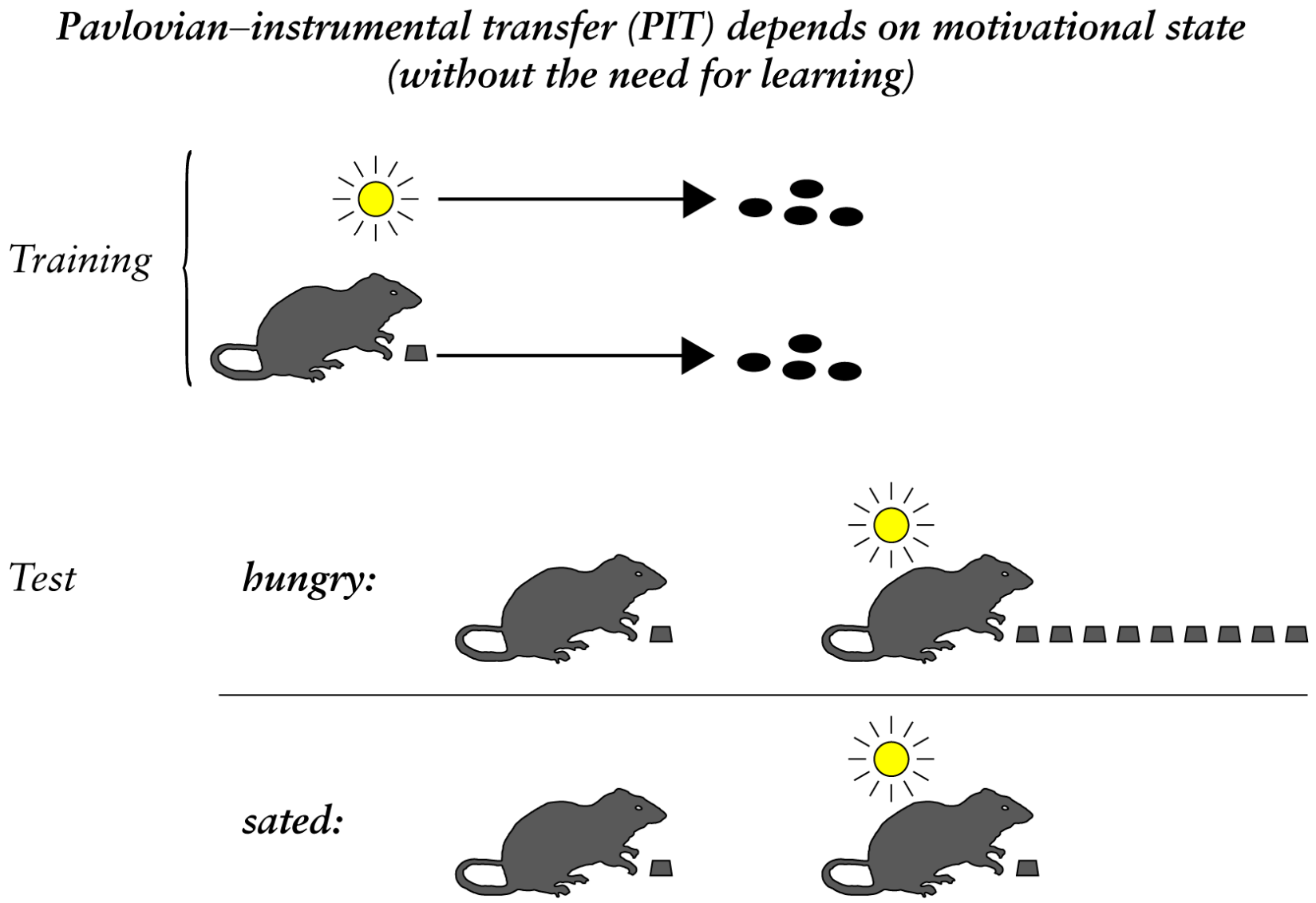
Training



Test



Pavlovian–instrumental transfer depends on motivational state



Dickinson (1986); Dickinson & Dawson (1987a, 1987b)

Conditioning and addiction

Environmental stimuli (cues and contexts) may become associated with the effects of drugs such as cocaine through Pavlovian conditioning. They become conditioned stimuli (CSs).

They may motivate an addict to seek out drugs — cue-induced (conditioned) craving.

Above photos (and others in following articles) courtesy of Inspector Richard Groves, Community Involvement and Crime Prevention Branch, New Scotland Yard.

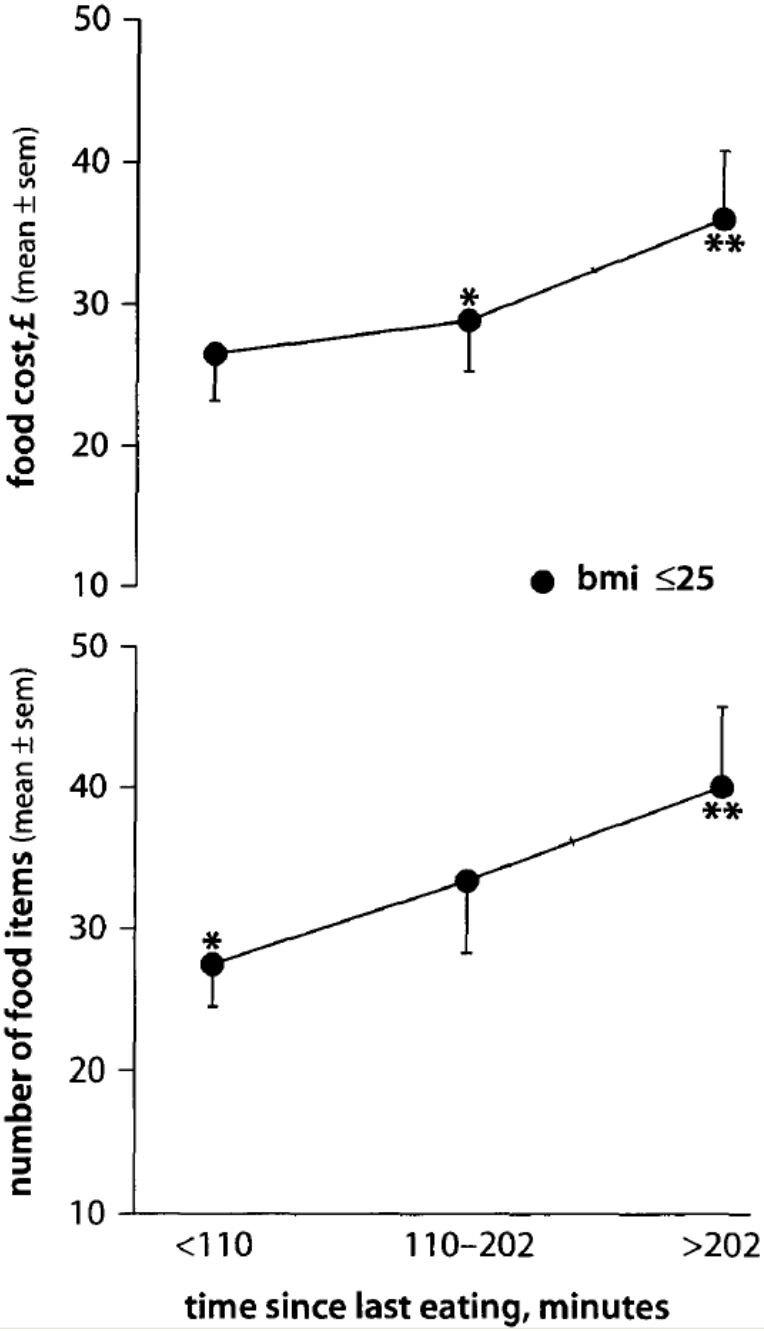
Pavlovian–instrumental transfer? Supermarkets

Static advertising, of course, and advertising to children (works: e.g. Galst & White 1976 *Child Dev* 47:1089), but also auditory / visual stimuli:

"Tesco TV is being established to… provid[e]… offers and value propositions from Tesco, its partners and advertisers — where it can be of most value, in-store where many purchase decisions are made… 7 'zones' were identified in-store where programming could be targeted to make the best use of 'dwell time' to create a positive effect for the customer and advertisers… [Grocery, Beers / Wines / Spirits, etc.]…The trial began in 3 stores and its impact was comprehensively researched with Tesco customers… proposed roll-out to 300 stores."

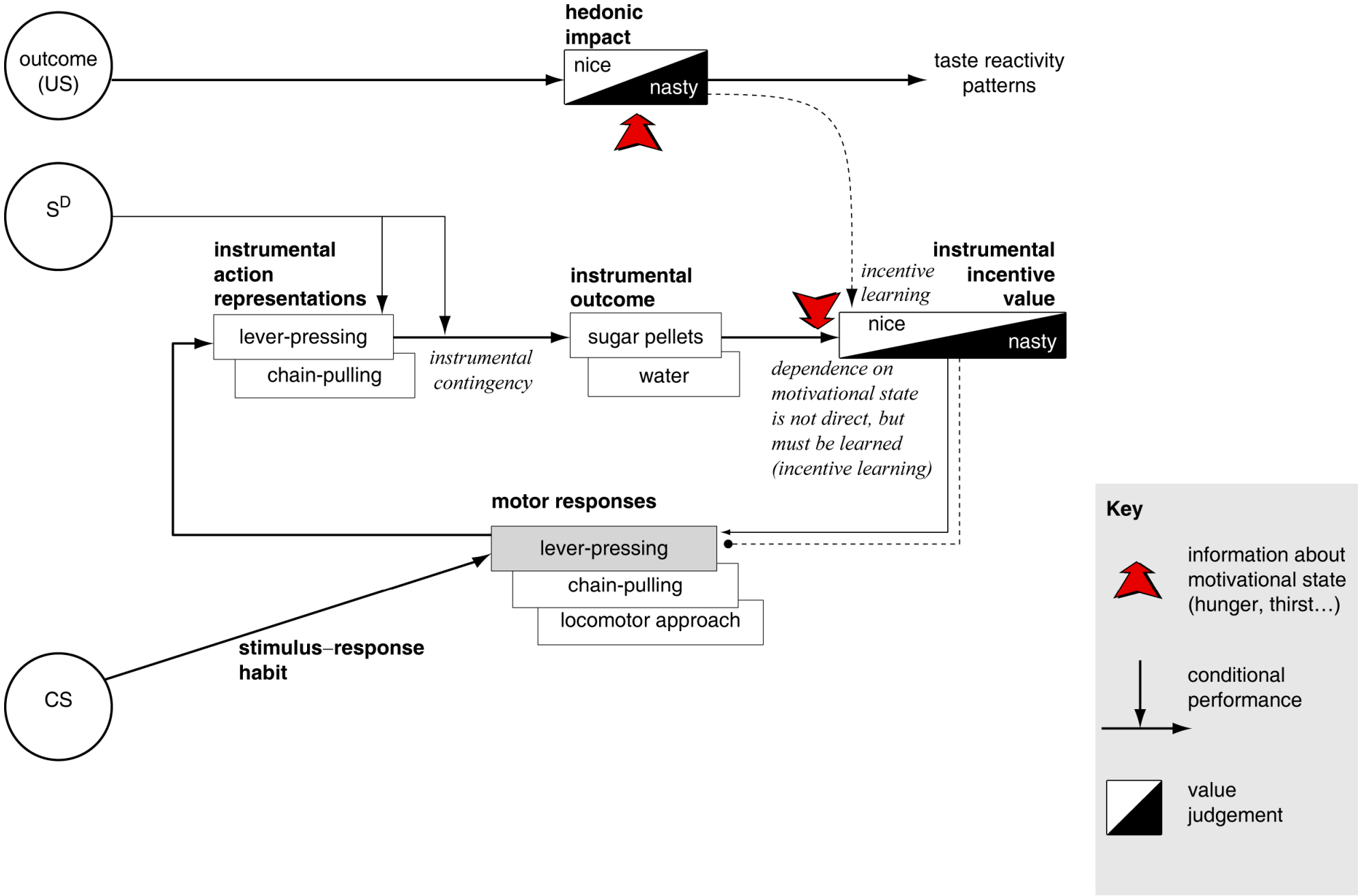
http://www.visagegroup.com/clients-retail-tesco.htm, 17 Feb 2004

Shopping and motivational state

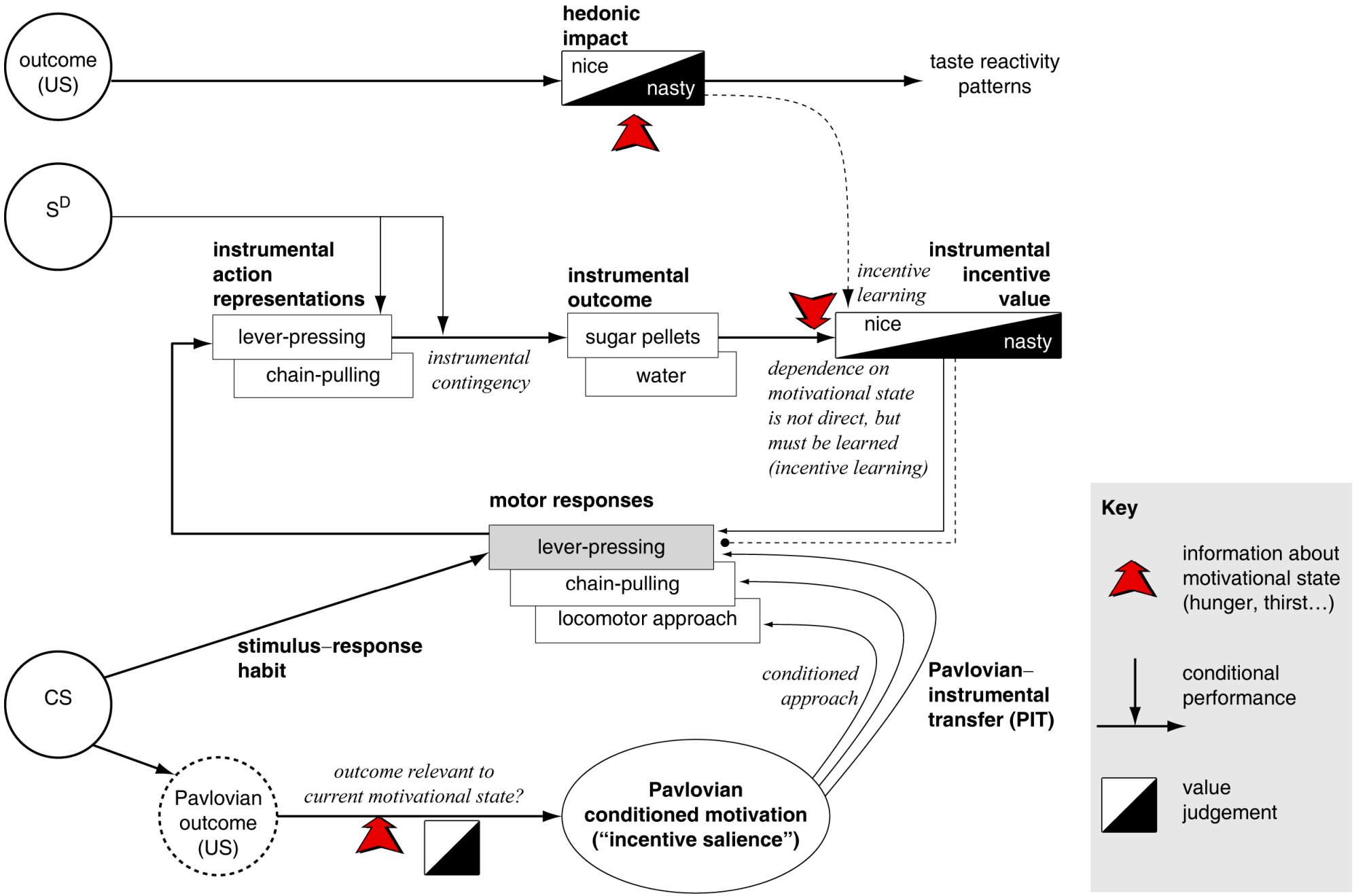


Mela et al. (1996)

The story so far… (3)



The story so far… (4)



Summary

- Reinforcement must be defined carefully to avoid circular arguments. Theories (Skinner, Hull, Premack, Timberlake).
- Motivational states are internal 'hidden' variables that help to explain behaviour.
- Apparently goal-directed behaviour is complex; several representations / processes contribute. For example, an animal learning to respond for a reward encodes
    - the instrumental (action–outcome) contingency;
    - the value of the outcome as an instrumental goal;
    - the (dissociable) 'hedonic' value of the outcome;
    - direct stimulus–response 'habits';
- … and is influenced by Pavlovian processes including conditioned reinforcement and Pavlovian–instrumental transfer.
- Motivational state affects several of these processes.